

2/pv/b

Shelf for supporting articles, particularly in  
refrigerated installations

The present invention relates to a shelf for supporting  
5 articles and which is intended to be fixed or mounted,  
in a horizontal or approximately horizontal position,  
in the chassis of a unit. In particular, it relates to  
a shelf that can be used in refrigerated compartments  
(refrigerated cabinets, chillers, refrigerators, etc.)  
10 for supporting articles, particularly food.

In domestic refrigerators, it is known practice to use  
shelves in the form of solid plates made of plastic or  
glass, such plates being simple to clean, hygienic and  
15 able to support all kinds of foodstuffs. These plates  
are usually equipped with a plastic surround that makes  
it possible to avoid the risk of injury on the sharp  
edges of the plates and/or makes it possible to  
strengthen said plates. Precise and attractive  
20 production of this surround making it possible to  
guarantee a good seal between the surround and the  
plate consists in injecting the plastic around the  
periphery of the plate placed in a mold so that it  
sandwiches (or embraces) the plate, gripping it on its  
25 edge and on its top face and underside. This is the  
"encapsulation" method. The material may also be  
injected around shelf support elements allowing this  
shelf to be mounted in the refrigerator. Encapsulation  
does, however, require specific installations limited  
30 to each type of shelf produced, may be complicated, and  
expensive, it also being possible for the shelves  
obtained to have disadvantages (limited ability to  
adapt to various types of structure, etc.).

35 It is also known practice to form the plastic surround  
independently of the plate (attached surround) and then  
for the two to be secured together by bonding (gluing).  
This method has advantages in terms of simplicity,  
cost, ease of adaptation, etc., but may pose problems

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in terms of the robustness or longevity of the assembly and/or of appearance and/or of sealing.

The object of the present invention is to provide  
5 shelves which are improved with respect to the existing shelves as previously described. This objective is achieved by virtue of the shelf according to the invention. This shelf comprises at least one panel intended to take (receive) the articles, and at least  
10 one attached (or "added") plastic structure (or surround) mating with (or fitting or following or hugging) the edge of the panel and/or exerting lateral pressure on the edge of the panel (for example holding the panel by compression of its edge or exerting radial  
15 pressure on the panel). According to one particularly advantageous embodiment, this adaptation to the contours of the panel and/or this compression are obtained by shrinking the plastic (or the plastic structure) as explained later on.

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The panel (or plate or sheet) of the shelf according to the invention is generally rectangular, rigid, has an approximately flat surface for supporting articles (top face, in the position of use) and is not very thick  
25 with respect to its area. It is generally formed as a single piece (monolithic) but may also be more complex (in the form, for example, of a laminated structure comprising several sheets of glass and/or of plastic and/or of other materials). It may be opaque or  
30 translucent but is preferably at least partially transparent, for esthetic and practical purposes; it may also be equipped with functional or decorative layer(s) or pattern(s) (for example in enamel or ink) on one or more of its faces.

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The panel may for example be made of glass, polycarbonate and/or polymethyl methacrylate. As a preference, it at least comprises or is in the form of a sheet of glass, a material which is advantageous in

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- terms of hygiene, rigidity, longevity, etc. For safety reasons, this glass is generally toughened, particularly in the case of a monolithic panel. The panel is usually solid, but may also comprise one or more reliefs and/or recesses and/or holes (for example for air circulation) and/or may have undergone one or more surface treatments such as sandblasting, striations, etc.
- 10 The plastic structure (or plastic support or surround) allows the panel to be supported and coats its sharp edges for more comfortable and safe handling of the shelf. In general, it is in the form of a frame, this frame offering one or more supporting surfaces (or bearing surface or base) for supporting the panel, these supporting surfaces, which are horizontal or approximately horizontal in the position of use, delimiting a region the dimensions of which correspond approximately to the dimensions of the underside of the panel. These supporting surfaces may, for example, be in the form of small tongues or lugs (or studs) projecting from the frame, on the underside in the position of use and around the central opening of the frame in which the panel is to be placed; this may also be a continuous supporting surface in the form of a frame supporting the panel at its periphery or alternatively, the plastic structure may also be solid and support the panel over its entire underside, or may support the panel at points other than on its periphery.

The plastic structure may have a small thickness (barely exceeding that of the panel) or a greater thickness, for example over certain parts of its periphery, with one or more walls on one and/or other of the sides rising up above the plane of the panel and/or protruding underneath below the plane of the panel (considering the shelf in its position of use).

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The plastic structure generally borders the panel around its entire periphery, particularly on its edge (or, to put it in an equivalent way, its thickness or its edges if considering each of the sides separately) and possibly over at least part of at least one of the top face and underside of the panel (for example it may cover the top face around all or part of its periphery over a width of a few millimeters and have parts which protrude slightly on the underside to support the panel, or it may not cover the top face of the panel and simply cover part or even all of its underside). Furthermore, the walls may border just part of the edge (or edges), it being possible for example for a wall to have openings over part of the edge at least along one of the sides.

The edges or walls of the plastic structure may be straight and uniform or of a more complex shape, in particular may have peripheral parts or extensions for functional or esthetic purposes. For example, the structure may have an extension forming a handle on its front edge (or along one side of the shelf intended to remain free) and/or may have an upstand, for example along its rear edge, acting in particular as a stop to prevent products placed on the shelf from coming into contact with the wall of a refrigerated unit containing it and/or may have side walls or lateral extensions extended, as appropriate, by projecting fins or lugs or studs or projections, and capable of sliding between rails or on supports formed in the lateral walls of a unit, etc. Reinforcing elements, fasteners, etc. may also be attached (added) or provided in the plastic structure, such as metal assembly elements (as explained later on), or reinforcing ribs or attachment means, etc. It is also possible to provide at least one channel, for collecting liquids if need be, or along which liquids can flow.

In one embodiment, the plastic structure may have or

may collaborate with lighting means (preferably low voltage). For example, a light may be situated in a housing provided in the plastic structure. One surface (for example the underside) of the panel may be treated or machined, for example sandblasted or grooved, to amplify this illumination effect by refracting the beam of light emitted by a light source. The electrical power supply for lighting the light may be associated with the opening of the door of the container in which the shelf is positioned or may be associated with the operation of a special push-button switch.

The plastic structure is, according to the definition given above, an attached part, that is to say one not  
15 formed directly on the panel but formed separately (or preformed) before being assembled with the panel. This structure requires equipment which is not as expensive as in the case of shelves formed by encapsulation, is simpler and offers greater flexibility.

In the shelf according to the invention, the plastic structure mates with (or fits) the edge of the panel and/or exerts lateral pressure on its edge. This may be all of the edges as seen earlier or possibly part of the edges. Advantageously, the plastic structure mates with at least two opposing edge parts (for example part of each of the lateral sides) and preferably at least two sides facing each other along their entire length and, as a particular preference, mates with at least part of the edges along all the sides of the shelf (front, lateral, rear sides). Advantageously, the structure mates with the panel around its entire circumference. It also mates with the panel over at least part of its height (or thickness), or even over its entire height.

This adaptation to the contours of the panel is advantageously obtained by shrinking the plastic. Alternatively or in addition, it may be obtained by

using a plastic structure formed of at least two plastics ("two-material structure"), one of which is more flexible and intended to be in contact with the panel (particularly in contact with the edge of the panel) and best mates to its shape, this more flexible material partly, and perhaps fully, covering the other more rigid material (which provides the structure with integrity).

10 As an alternative to or at the same time as the adaptation to the contours of the panel, the plastic structure also presses the edge of the panel (or exerts radial pressure on the panel). The plastic structure holds (or retains) the panel by compression of its edges (at least in part, particularly at least part of the two opposing sides), which gives the association better rigidity and longevity. This pressure may be obtained mechanically by force-fitting (that is to say exerted by forcing) and/or may be obtained advantageously by shrinking the plastic, as explained below. In the preferred embodiment where it is obtained by shrinking the plastic structure, the force compressing the structure onto the edge of the glass is generally of the order of a few MPa, preferably at least 5 Mpa, and does not exceed 15 MPa, for example is of the order of 8 to 10 MPa.

As indicated previously, precise adaptation to the contours of the panel and retention by radial compression are preferably obtained by shrinking the plastic (the shelf according to the invention in this case being rather more defined in that the panel is secured to the structure by shrinking the structure (or the plastic of said structure)). Note that more generally and independently of the above definition, the present invention also covers, by way of a shelf, any shelf, particularly for a refrigerator or the like, comprising at least one panel and at least one attached plastic structure, the shelf being obtained by



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simpler to manufacture and offers greater possibility of adaptation to existing structures. It also has particularly satisfactory rigidity and longevity.

5 The present invention also relates to a method for obtaining the shelf whereby the plastic structure is formed separately from the panel by hot molding (in the hot state or under heat), the panel being assembled with the plastic structure after molding before the  
10 plastic has fully shrunk.

The structure may be molded for example by injecting a plastic, previously heated and melted, into a closed mold or an injection-molding machine (or press), the  
15 plastic being, for example and advantageously, polypropylene, possibly filled with talc to improve its mechanical robustness, or acrylonitrile-butadiene-styrene (ABS), etc., the plastic being chosen according to the characteristics, particularly strength, desired  
20 for the structure, but also according to its ability to shrink as required in the invention. Once molded, the material cools and solidifies, first in the mold (or press) to give a semi-finished product which can be removed from the mold without losing its overall shape,  
25 then out of the mold, the shrinkage phenomenon occurring especially after the mold has been opened and all the more so after extraction from the mold (the dimensions reducing but the shape remaining more or less the same).

30 Advantageously, the panel is assembled with the plastic structure after (or "just" after) the mold has been opened (or after it leaves the press) and preferably outside the mold, preferably before shrinkage reaches  
35 40% (and preferably 30%) of the total shrinkage. In practice, this assembly often occurs in the 10 minutes, and preferably in the 4 minutes, following the opening of the mold (or the press), it being possible for the plastic to continue to shrink thereafter for several



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hours, but to an increasingly limited extent.

In the case of intermediate treatment, such as the deposition of an adhesive on the structure (as explained hereinafter) between molding and assembly, and in order to avoid excessive or excessively fast shrinkage of the plastic, it is also possible to envisage holding the structure at a temperature as it leaves the mold or press (for example holding the structure at a temperature of the order of 60°C in the case of polypropylene), for example by providing a temperature maintaining (soak) tunnel on the manufacturing line.

The shrinkage of the plastic allows better adaptation to the contours of the panel but may not be enough to guarantee the longevity of the assembly (there may still be some clearance at certain points along the interface between the structure and the panel or insufficient radial compression to hold the panel). In this case in particular, the integrity of the assembly in terms of mechanical strength and/or sealing may be ensured jointly or alternatively by other means such as clipping and/or gluing. For example, tabs or tongues or lugs may be provided on the structure to hold the panel by clipping, the panel then being inserted, generally by force, between the tabs or tongues or lugs and the remainder of the structure before the structure has fully shrunk. In an advantageous mode of assembly, the tabs or tongues or lugs are on the underside of the structure and also act as supporting surface for the panel, the panel being inserted (generally by force) from the side of the structure that constitutes the underside of the shelf in the position of use (the structure in this case possibly being inverted during assembly or possibly leaving the mold in an inverted position). This method of assembly on the underside may also be used with advantages independently of the shrinkage of the structure.

As a preference, prior to assembly and generally after opening the mold (except perhaps in the case of two-  
 (shot) injection molding deposition as mentioned later  
 5 on), adhesive(s) is(are) also deposited over at least part of the structure that is to be in contact with the panel (part of the supporting surface and/or possibly on parts of the structure which are to be in contact with the edge) so as to further improve the seal and  
 10 adhesion between the structure and the panel. This is preferably an adhesive of the elastic (or viscoelastic or soft) type, for example of the polyurethane type, making it possible to compensate for the respective expansions of the panel and of the plastic which are  
 15 due to temperature changes in transport or in use (there being a risk that a "hard" adhesive would break in shear or become detached during temperature changes). The shelf according to the invention may thus comprise, aside from the plastic structure and the  
 20 panel, an adhesive, preferably deposited around the periphery of the structure (in the form for example of flexible bead which is squashed when the panel and the structure are associated).

25 Note that in the embodiment where assembly is achieved by using shrinkage, clipping and adhesive bonding at the same time, the structure generally, as (or after) it leaves the mold and after possible transfer through a temperature maintaining tunnel, is equipped with  
 30 adhesive at the appropriate points before the clipping of the panel and the complete shrinkage of the plastic.

As mentioned previously, the plastic structure may also be formed of at least two plastics (two-material  
 35 structure), one of which is more flexible, and covers the other which is more rigid, and is intended to be in contact with the panel so as to better mate with its shape, the flexible material being squashed when the panel and the structure are associated (in the cold

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state from the formed structure and the panel, or in the hot state as in the method described previously) for better contact and better sealing between the panel and the plastic structure. This two-material plastic structure may be produced by two-injection molding (injecting the different materials in the same mold, generally one after the other).

As an alternative to the adhesive and/or to the makeup of the plastic structure, or in addition, it is possible to use one or more insulating beads or gaskets, self-adhesive or not, which may or may not be in the form of foam (or of a hot melt adhesive blown with air bubbles); it is also possible to give the gasket or bead of adhesive deposited a special shape (for example conical) for better contact when the gasket or the adhesive is squashed mechanically between the panel and the plastic structure. The surface of the panel may have been treated beforehand (at least in part) for example by sandblasting, so as to improve its grip (hold, key) for adhesive, and/or the plastic structure, after the opening of the mold and prior to the application of adhesive may have undergone a surface treatment (on the parts intended to receive the adhesive) such as goffering (formation of striation) or the formation of roughness or a plasma treatment (by spraying an ionized gas or projecting a flame over the plastic surface) to increase the area of contact between the plastic and the adhesive and/or to create other points of attachment, or may alternatively have been equipped with a groove to accommodate the gasket or the adhesive.

As previously mentioned, assembly may be on the underside of the structure; it may also be on the top side, the top side of the panel remaining uncovered or being inserted in clips or protruding parts. In the absence of such protruding parts, the shrinkage of the plastic or an additional heat treatment may also cause

the appearance of a small bulge which presses against the top face of the panel (in the position of use) and, as appropriate, on the gasket and/or the adhesive and/or the flexible material of the plastic structure so as to provide additional sealing. Possibly, and depending on the plastic used, the shelf may also be obtained simply after an additional heat treatment of the plastic structure (reheating) subsequent to the molding of said structure, the panel being assembled with the structure after this additional heat treatment, an adhesive and/or a surface treatment possibly being deposited or performed prior to assembly.

As an alternative or in addition to the shrinkage of the plastic structure, it is also possible to produce the plastic structure by a technique known as "air molding" (or injection of plastic assisted by gas), this technique making it possible to obtain a shelf which has good robustness and rigidity with less material than conventional molding. This technique consists in introducing a pressurized inert gas (for example nitrogen) into the molten plastic during molding after the partial filling of the mold cavity so as to create, within the molded part, regions of greater thickness and empty regions. Air molding makes it possible, for example, to create reinforcements (extra thicknesses, ribs, etc.) along the sides of the plastic structure and possibly lateral support arms in the very body of the plastic structure. This technique also allows more rapid cooling of the molded part and shorter production cycles, and makes it possible to obtain a particularly satisfactory surface finish.

To suit certain uses of the shelf according to the invention, the invention also proposes elements for assembling (or mounting) the shelf in units (for example for cantilever mountings), these assembly elements being fixed by clipping (or catching, in

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particular being fixed mechanically by imbrication means such as recesses and/or protrusions, teeth, lugs, studs) onto the plastic structure of the shelf (more precisely underneath as a general rule) and

5 advantageously having at least three parts. These elements are initially (each) in the form of a leaf (or fin or platelet), generally made of metal, and bent (for example by stamping) so that it has an approximately L-shaped cross section with at least one

10 leg of the L (or first part of the element) intended to be clipped, under the panel, against a vertical wall of the plastic structure protruding from the underside of the panel and at least one part (second part of the element) of the other leg of the L intended to be

15 clipped under the supporting surface of the plastic structure. These elements also initially have, at one of their (longitudinal) ends, a hook for the possible cantilever mounting of the shelf in a unit. The third part is formed by the end of a leg; depending on the

20 mounting method envisaged, this end is either bent so that it rims (borders) another part of the shelf, particularly the plastic structure (the three parts therefore in this case holding the shelf in three directions, providing better stability and better

25 robustness for the assembly), or fashioned to form a runner (or sliding channel) intended to collaborate with additional cantilever-mounted means for catching onto the unit (to form a sliding shelf), these additional means (for example in the form of a metal

30 frame collaborating with the assembly elements) in this case being caught by hooks onto the unit, it then being possible for the hooks of the assembly elements to be removed by cutting them off. The adaptation of the third part of the assembly elements and the possible

35 cutting-off of the hook may advantageously be done at the last moment depending on the type of attachment required. It is thus possible to use the same shelf for all types of attachment (for example without the assembly elements for a shelf held on the side walls of

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the unit, or with the assembly elements for a cantilever attachment, whether this be in fixed or sliding mode). Note that the assembly elements described previously are also advantageous for any type  
5 of shelf other than the one of the invention.

The assembly elements previously described may, as the case may be, be considered independently of the shelf or as forming part of it and may be fixed definitively  
10 or detachably to the shelf. They guarantee not only the securing of the shelf to the wall but may also contribute to reinforcing the shelf. In general, at least two assembly elements are needed for mounting the shelf in a unit when the shelf is to be mounted  
15 cantilever fashion, these elements generally being fixed to the lateral sides of the shelves. As indicated previously, these elements may also slide on a frame fixed to the unit, this frame or runner advantageously being formed as a single piece (for example by  
20 stamping) for better strength and generally being made of metal. In this case and advantageously, sliding is between the assembly elements acting as intermediate elements and the additional support frame, and not directly between a support frame and the plastic  
25 structure.

As indicated previously, when the shelf is intended to be fixed cantilever fashion to the rear wall of the unit, the shelf has at least two parts projecting from  
30 its rear side (originating from the assembly elements when the shelf is intended to be mounted fixedly or from the additional frame when the shelf is intended to be mounted so that it can slide), which act as hooks or teeth to engage with (and be retained in) rungs or  
35 holes in rails fixed to the rear wall of the unit so that the shelf cantilevers forward from said wall.

The shelf can also be fixed on the side walls of a container or may rest or slide, via its plastic



particular for supporting articles in a refrigerator  
 and comprises a glass panel 1 (possibly with an  
 enameled edging to conceal the join with the plastic  
 structure, the side walls also possibly concealing this  
 5 join via the shadow they cast), equipped with a  
 structure (or surround or frame) made of polypropylene  
 2. This assembly is obtained as follows: polypropylene  
 granules (preferably filled with talc to improve the  
 mechanical strength of the polypropylene) are heated in  
 10 a plasticizing chamber of an injection-molding machine  
 to a temperature that is high enough that the plastic  
 can be injected and the molten material is injected  
 into the mold or injection-molding machine to obtain  
 the semi-finished product which, through the shrinkage  
 15 of the plastic, will yield the structure 2. The  
 material cools in the mold and solidifies from 160°C in  
 the form of a semicrystalline product. When the mold is  
 open to remove the molded frame, the plastic reaches  
 about 70°C. The shrinkage of the plastic then begins to  
 20 occur to a significant extent. In the 4 minutes (and  
 preferably in the 1 to 2 minutes) following removal  
 from the mold, the surface 4 of the frame on which  
 surface the panel is to rest possibly undergoes a  
 surface treatment (for example of the plasma type), is  
 25 preferably coated with adhesive (it being possible for  
 handling to be automated) using an elastic adhesive (a  
 channel - not depicted - may possibly be provided to  
 accommodate the adhesive on the surface) and the glass  
 panel is placed on the frame (position a of the frame  
 30 depicted in fine and dotted line in figure 2).  
 Shrinkage then continues to occur (about 75% of the  
 shrinkage takes place in the first 15 minutes, it being  
 possible for final shrinkage to take several hours)  
 until the frame reaches its definitive shape (position  
 35 b of the frame depicted in thick line in figure 2). In  
 this state, the frame mates with and mechanically holds  
 the glass on its edge 3, with a compressive force of  
 the order, for example, of 9 MPa exerted on the edge of  
 the glass. In a frame of the order of 420 mm wide, the



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final shrinkage may, for polypropylene, be as much as 4 mm. The assembly obtained is particularly robust and meets the safety standards.

5 The frame here comprises a supporting surface 4 in the form of a frame, two lateral walls 5 with an upper part 6 forming a small rim protruding from the top face of the panel and a lower part 7 under the underside of the panel, a front extension 8 forming a handle for  
10 handling the shelf, a rear extension possibly with a channel 9 for collecting or removing liquids in the event of a spillage on the shelf, and with an upstand 10 to prevent items from coming into contact with the rear wall of the refrigerator.

15 The frame may also be equipped with catching (and/or retaining and/or locking) means 11 (as illustrated in figure 3) in the form of lugs, protrusions, clips, stops, etc., making it possible, for example, for  
20 assembly elements 12 (figure 1) or 12' (figure 4) to be mounted. These elements, for example metal plates obtained by stamping, have a first part (or leg) 13 equipped initially at one of its end with a hook 14 for mounting on rails provided on the rear wall of the  
25 refrigerated compartment (this hook being cut off for the sliding version depicted in figure 4), a second part 15 which is bent with respect to the first (the entity having an L-shaped cross section), the first part being clipped onto the internal wall 16 of the  
30 lower part of a lateral wall 5 of the frame, the second part being clipped under the supporting surface 4, clipping (or fixing or imbrication) of the assembly elements with the frame being achieved using means that complement those provided on the frame (in this case in  
35 particular recesses 17), and a third part 18, 18' which is either bent (figure 1) with respect to the second part so as to follow the contours of the supporting surface (for example covering part of its thickness 19) or fashioned so that it forms a runner (figure 4), it

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being possible for this bending into the chosen configuration to be done at the last minute. In this latter sliding version, it is also possible to provide a part 18'' or lug butting against the thickness of the supporting surface of the frame, the fact of bordering the frame in three directions or parts making the entity more secure.

In this instance, the shelf gets at least two assembly elements, each element being mounted under one of the lateral walls of the shelf, for example after storage and possible drying of the shelf obtained as described previously and depending on the desired method of attachment.

In the sliding version illustrated in figure 4, use is also made of a metal support 20 or runner, formed as a single piece for example by stamping and equipped with hooks 21 for fixing it to the rear wall of a refrigerator, and having surfaces 22 or runners intended to collaborate with the corresponding runners 18' of the assembly elements to allow the shelf to slide. Stops 23, 24 may be provided on the assembly elements and the sliding support to arrest the movement of the shelf in mid-travel for safety reasons.

The shelf described earlier may be considered as simply being formed of the panel and of the frame (the frame possibly being fashioned in such a way that it can be slid by its sides in the lateral runners of a refrigerator) or may be considered as being equipped with the assembly elements, or even with the previously mentioned additional frame.

The shelf according to the invention is particularly well suited to the supporting of items and elements in a refrigerated compartment or a refrigerator (a refrigerator equipped with the present shelf also being something at which the invention is aimed) but may also

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be suitable for supporting other types of items in other types of unit.